

## ***Indiana bat***

### Status

Federal status: G2 N2, Endangered

NH state status: Not ranked or listed

ME state status: Not ranked or listed

Based on hibernaculum censuses, Indiana bat populations decreased by 57% from 1960-2001 across their range. These declines do not tell the whole story however. Southern populations of the Indiana bat, in states from Virginia and Missouri south, declined 80% from 1960-2001. Northern populations have actually increased by 30% during the same time (Clawson 2002).

The expert panel did not think this species is likely to occur on the WMNF, so did not provide outcomes for the Forest. They said it is unknown whether increasing populations in the northeast are from increasing local populations or emigration from the south and midwest. If the trend continues and populations expand further, they could eventually move into New Hampshire.

### Distribution

Ranges from Iowa, east to Vermont, south to western North Carolina and northern Alabama, and west to eastern Oklahoma. There are questionable or isolated records in northern Florida, southwestern Alabama, and Michigan. They hibernate in more than 300 locations in 26 states, but more than half of all known Indiana bats hibernate in only seven caves and one abandoned mine, which are all located in Indiana, Kentucky, and Missouri.

Neither New Hampshire nor Maine identify this species as one that occurs in their state. One male bat was identified as an Indiana bat during a mist-netting survey on the WMNF. The identification was not confirmed and no other Indiana bats have been documented in New Hampshire during generic and targeted surveys. The expert panel agreed that this species is not likely to occur on the WMNF, although there is potential for a rare accidental occurrence. The nearest known hibernaculum is in Dorset, Vermont.

### Habitat

This species uses different habitats in the winter and summer. In winter, it hibernates in caves and mines. In summer, maternity colonies are in trees, while others roost in caves and trees. Summer roosts of all types are usually within a few hundred meters of intermittent and perennial streams and rivers.

For hibernation, limestone caves with standing water are preferred. Indiana bats require roosts with stable temperatures below 10°C when they arrive in late fall and 3-6°C in mid-winter. Relative humidity also is important to hibernation habitat; it is usually above 74% but below saturation. Few caves and mines within the range of this species provide the preferred temperature and moisture conditions.

In the summer, pregnant females form maternity colonies under the loose bark of snags and trees. The presence of exfoliating bark, exposure to sunlight, and proximity to other trees seem more important in selecting a maternity roost than snag or tree species. Most

roost trees are larger than other available trees, with diameter at breast height often measuring 40+ cm, though it may be as small as 22 cm. Roost trees have a limited “lifespan” because snags fall over and exfoliating bark is shed. However bats will use a roost tree for as long as it is suitable.

Maternity roosts usually occur in floodplain and riparian forests or upland forest areas. They are unlikely to be in mature coniferous forest. Maternity colonies typically have 1 or more primary roosts that receive direct sunlight for much of the day, and alternate roosts in other trees that may be shaded or in the open. The preferred level of shading seems to be variable; some roosts are unshaded and others have >80% canopy cover. It is unknown if there are maximum or minimum temperatures that would help define habitat suitability. A single colony can have a dozen or more alternate roosts, which are usually within a few hundred meters of the primary roost snag or tree. Bats move between roosts every few days. Primary roosts are used during much of the summer by most of the colony; alternate roosts are used during warmer weather and rain.

Occasional maternity colonies have also been found in tree cavities and cracks, buildings, and bridge crevices, and behind shutters. Only trees and snags have been documented as summer roosting sites in New England.

Males and non-reproductive females seem to spend summer alone or in small groups. What habitat they use is not well known, but seems to be variable. Some studies have found them using tree roosts, which are often more shaded and smaller than primary maternity roosts. Other work indicates that males spend the summer in cave and mine habitats. Males have also been found using artificial structures.

Indiana bats forage from 2-30 meters above the ground in or beneath the canopy of riparian, floodplain, and upland forests. Some forage over clearings and farmland and along forest edges, while others seem to avoid these areas. Openings and water habitat seem to be important for foraging in northern New England.

### Limiting Factors

In northern New England, the availability of suitable hibernacula may be a limiting factor, or may just be moving bats around. It is unlikely that bats not hibernating here will travel in this direction for summer roosting. In addition, the cool climate and dense forest of the GMNF and WMNF may limit the ability of this species’ to use these areas.

Impacts at hibernacula appear to be the greatest threat to Indiana bats across their range. Impacts come from natural disturbance, human disturbance, and habitat loss or degradation.

River flooding has drowned large numbers of bats in some caves, and presumably could have similar results in mines. Collapse of caves and mines can result in the death of hibernating bats and the permanent loss of winter roosting habitat.

Although more tolerant of some disturbance than other bats, Indiana bats are still very vulnerable during hibernation. Human presence causes metabolic increases, arousal, and reclustering, all of which use fat reserves faster than hibernation. Arousal can use up enough fat to sustain a bat for 10 to 30 days. In addition to impacts from arousal, there have been several instances where people purposely killed large numbers of bats in caves.

Some mines and caves have been closed by blasting or filling the entrance, which either traps bats inside or prevents their use of the site in winter. Gating of caves and abandoned mines can benefit bats if gating is done properly. However some gate designs can alter cave or mine microclimates, rendering them unsuitable for use by bats and increasing predation risks.

Destruction and development of summer habitat can alter or eliminate roost sites and foraging areas. Land clearing and development, stream channelization, and surface water management have all reduced suitable summer habitat in some locations.

Indiana bats can tolerate timber harvest in or near their summer roosting habitat if snags and trees suitable for roosting are protected. Harvest that creates small openings and edges can benefit bats that select for these habitat features. However harvest that clears large areas of riparian or other forest with suitable roost sites could decrease habitat quality and quantity.

Insecticides and other pesticides can kill bats directly and reduce prey levels. Heavy metals and other contaminants also reduce bat populations. Widespread global warming may affect insect communities and hibernaculum conditions. Wind turbines near large summer or winter bat roosts could kill thousands of bats.

Roads leading to cave and mine sites can increase the potential for people to disturb or harm bats and for cave and mine sites to be used as garbage dumps, which can block entrances or introduce toxic substances.

Human activity also can provide habitat for these bats on a small scale. Male Indiana bats have been documented using bat boxes in some areas. Small logging roads may provide suitable travel corridors. Logging and sugar bushes can create or maintain open forest habitat that is suitable for summer roosting.

With an average of only one young per year, Indiana bats have low reproductive rates compared to other small mammals. The fact that the species is colonial makes it more likely that a given disturbance or habitat loss event will impact a large number of bats. These two factors combined mean it can take a long time for their numbers to recover from other threats.

#### Viability concern

Substantial declines in a large part of its range, and a wide array of continuing threats, indicate this species' is likely to remain a concern for many years. According to the expert panel, the WMNF is not likely to have this species on a regular basis. However it is a federally listed species that has been captured once on the Forest, so we must address it until studies document that does not rely on the Forest for any part of its life history.

#### Management activities that might affect populations or viability

WMNF management does not affect many of the threats facing this species. The Forest does not have any known hibernacula.

As stated under limiting factors, timber harvest can be beneficial or negatively impact summer habitat, depending on the location and harvest methods. Measures to protect snags, trees with exfoliating bark, and riparian forest should reduce the potential for impacts.

No wind turbines currently exist on the WMNF. However occasional requests come in. If a permit is ever given for this type of structure, there is potential for impacts to the Indiana bat.

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